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(71)Applicant : CENTRAL GLASS CO LTD
NISSAN MOTOR CO LTD

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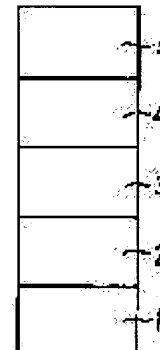
(72)Inventor : IIDA HIRONOBU
TOMIOKA TAKAO
SHIBATA ITARU
NISHIDE RIICHI
SHINODA MASATO

(54) ULTRAVIOLET HEAT RAY SHIELDING WINDOW

(57)Abstract:

PURPOSE: To provide the UV and IR shielding window having performance to simultaneously shield IR heat rays and UV rays with simple layer constitution by successively laminating a first transparent dielectric film, second transparent dielectric film, metal or metal nitride film and third transparent dielectric film on a transparent substrate.

CONSTITUTION: This UV heat ray shielding window is successively laminated, successively from a transparent substrate 1 side, with the first transparent dielectric film 2 as a first layer, the second transparent dielectric film 3 different from the first transparent dielectric film 2 as a second layer, the metal or metal nitride film 4 as a third layer and the third transparent dielectric film 5 as a fourth layer. The optical characteristics of the UV heat ray shielding glass formed in such a manner have 70% visible ray transmittance and have the sufficient visibility required as a windshield for automobiles. The shielding glass has 57% sunshine transmittance and sufficiently shuts off the heat rays of the solar light. The performance to shield the UV rays is $\geq 10\%$ transmittance of 380nm wavelength and sufficiently shuts off the harmful UV rays.



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DETAILED DESCRIPTION

[Detailed description]

[0001]

[Field of the Invention] this invention relates to the ultraviolet rays and the heat ray cutoff window for which it is suitable as a window for vehicles like an automobile. It is used it is more desirable and suitable for 70% or more of a visible-ray permeability site, and the window of this invention can apply [50% or more of visible-ray permeability, and] veneer glass, a double layer, and laminated glass. Moreover, although the window of this invention is devised as a window for automobiles, it is not limited to the window for vehicles and can be applied also to various apertures.

[0002]

[Prior art] In order to intercept the specific wavelength fraction of the solar light irradiated by the vehicle interior of a room through the glass of a window from the viewpoint of energy saving from the former, to reduce the temperature rise of the vehicle interior of a room and to reduce the load of a chiller machine, the high window of adiathermancy is demanded.

[0003] The technique of ****ing the transparent conductivity layer which is called Drew Demi Ra and which is represented by the layer which added aluminum on the transparent substrate to the mixed layer (ITO layer) and zinc oxide of indium oxide and a tin oxide, and intercepting a heat ray and infrared radiation as the technique of intercepting heat ray and infrared radiation, is learned. The wavelength intercepted although surely this type of glass intercepts infrared radiation is 1.5 micrometers or more, and a heat ray and an infrared cutoff performance are not so good. Moreover, carrying out the laminating of various kinds of metal membranes and the dielectric film, using the optical interference effect, and making the light of specific wavelength reflect or penetrate is known. The heat reflective glass using the optical interference effect has glass of a configuration of having inserted the silver film currently indicated by the Japanese Patent Publication No. 6315 [47 to] official report by the transparent dielectric film. Moreover, there is also a heat reflective glass of a configuration of having inserted the nitride currently indicated by the Japanese Patent Publication No. 206333 [63 to] official report by the transparent dielectric film. Since these glass is aimed only at heat ray reflex nature, there is no below-mentioned ultraviolet-rays cutoff nature. The method of making a specific metallic element etc. mix into a glass plate, and making a heat ray absorb as the other technique is learned. Although heat ray cutoff nature is obtained by this type of glass adding a specific metallic element on glass, since the metallic element which weakens the mechanical strength of the glass plate [itself], and is used for obtaining good heat ray cutoff nature will be limited if an addition is increased, there is a problem in respect of the tint of a glass plate.

[0004] It is said that suntan will be produced on the other hand if ultraviolet rays are absorbed by the human body about ultraviolet rays, or a melanin carries out deposition, it becomes a silverfish and buckwheat dregs, and the skin is aged. Moreover, it is said that the color fade-out of interior material in the car and a degradation are also produced by the UV radiation. It is asked also for the glass which has an ultraviolet-rays cutoff function from such a viewpoint.

[0005] It considers as the technique of intercepting simultaneously a heat ray, infrared radiation, and ultraviolet rays to above needs. A heat ray and the technique of forming separately an infrared cutoff layer and an ultraviolet-rays cutoff layer in layers on a glass front face, respectively are learned. the zinc-oxide layer which has ultraviolet-sorption ability in a Provisional-Publication-No. 132902 [61 to] official report -- forming -- this layer top -- a zinc oxide -- aluminum 0.4 **** -- the ultraviolet-rays infrared cutoff glass which was 10 atom % made to contain and gave heat ray and infrared cutoff ability is indicated

[0006] However, if it was in this conventional ultraviolet-rays infrared cutoff glass, there was a trouble where the cutoff performance of ultraviolet rays and infrared radiation was not necessarily enough. Therefore, the purpose of this invention is to offer the ultraviolet-rays infrared cutoff window which improved the performance which intercepts an infrared heat ray and ultraviolet rays simultaneously by the simple lamination.

007]

[the means for solving a technical problem] In the ultraviolet rays and the heat ray cutoff window for which this invention is made that the above-mentioned trouble should be solved, and it is suitable as the object for automobiles, and a structural window. The 2nd transparent dielectric film which is different from the 1st transparent dielectric film as the 1st layer, and is different from the 1st transparent dielectric film as the 2nd layer from a transparent substrate side, is related with a metal or a metal nitride layer, and the ultraviolet-rays heat ray cutoff window characterized by carrying out the laminating of the 3rd transparent dielectric film one by one as the 4th layer as the 3rd layer.

0008] Drawing 1 is drawing showing the configuration of the functionality glass used by this invention, and one in drawing is a transparent substrate and consists of various glass plates, such as colorless soda-lime glass, blue, bronze, gray, glass with a green color, and alumino silicate glass, and a polymethylmethacrylate (PMMA), and a transparent silicon plate like a polycarbonate (PC). 2 is the 1st transparent dielectric film and consists of the multiple-oxide layer which added the metallic element of a minute amount to a cerium, titanium, zinc, chromium, the oxides of ***** these multiple oxides, and these oxides. 3 is the 2nd transparent dielectric film different from the 1st transparent dielectric film 1, and consists of silicon, titanium, aluminum, tin, a zirconium, a tantalum, chromium, stainless steel, the oxides of Nichrome, or those multiple oxides. 4 is a metal or a metal nitride layer, and consists of the metal chosen out of a metal or a nitride composites [of platinum, gold, silver, copper, titanium chromium, aluminum, Nichrome, stainless steel, a zirconium, a hafnium, or a tantalum / any one or these composites], or a metal nitride. 5 is the 3rd transparent dielectric film and consists of the oxides or those multiple oxides of silicon, titanium, aluminum, tin, a zirconium, a tantalum, chromium, stainless steel, or Nichrome.

0009] Although the 1st dielectric film 2 can be arbitrarily chosen from the above-mentioned dielectric, the complex-electrics layer which becomes especially a zinc oxide and a zinc oxide from a minute amount, the dielectric film of which 1-10 atom % addition was done and a zinc oxide, and transparent dielectrics, such as a silicon oxide, about iron and chromium is desirable. This ground is because it has the transparency in an ultraviolet-rays cutoff performance and light region excellent in the zinc oxide, and a good ultraviolet-rays cutoff performance can be obtained by setting a thickness to at least 100nm or more. Even if the 2nd transparent dielectric film 3 and the 3rd transparent dielectric film are the same, they can also use the thing of the different quality of the material.

010] In the ultraviolet-rays heat ray cutoff glass used by this invention, the site which has the function which intercepts a heat ray is the metal or the metal nitride layer 4 which mainly carries out a laminating as the 3rd layer. Generally, the conductive matter has the reflex nature of heat ray infrared radiation, and reflex nature also becomes good so that conductivity is good. A metal or a metal nitride reflects heat ray infrared radiation by the specific distance with the conductivity of 1×10^{-6} - 1×10^{-10} ohmcm. Moreover, in case a metal is used as the 3rd layer and 2-10nm and a metal nitride are used for the thickness, the transparency in a light region can be secured by choosing a thickness in 5-30nm. These layers can be *****ed also by the wet ***** methods, such as chemistry gaseous-phase methods, such as the various vacuum ***** methods, such as a spatter, a vacuum deposition, and the ion-plating method, CVD, and a spray method, and a sol gel process. Among these, the spatter and the sol gel process are excellent in respect of large-area-izing and the productivity.

011]

[operation] In the layer configuration shown in drawing 1 as an example of the layer configuration of the ultraviolet-rays heat ray cutoff glass used by this invention A glass substrate is used as a substrate 1. as a transparent dielectric film 2 on this substrate 300nm of zinc oxides, A titanium-nitride layer as 35nm and a metal nitride layer 4 for a silicon oxide as the 2nd dielectric film 3 15nm, When a silicon-oxide layer is set to 80nm as the 3rd dielectric film 5, the optical property of the glass of this configuration is fully intercepting solar light at 57% of solar radiation permeability with sufficient visibility demanded as a glass pane for automobiles at 70% of visible-ray permeability. Moreover, the cutoff performance of ultraviolet rays is also 10% or less in permeability with a wavelength of 380nm, and is fully intercepting detrimental ultraviolet rays.

012]

[example] An example explains this invention below.

After it carried out degreasing washing of the example 1 transparent glass substrate in isopropyl alcohol and the pure water next washed, nitrogen blow xerensis was carried out. This transparent glass substrate was conveyed in the sputtering system, and it exhausted to 5×10^{-6} Torr. In the vacuum tub, the zinc target for zinc-oxide layers used as 1st transparent dielectric film, the 2nd, the oxidization silicon target for silicon oxides used as 3rd transparent dielectric film, and the titanium target for titanium-nitride layers used as a metal nitride layer of the 3rd layer were installed.

013] First, as spatter gas, the exhaust speed and the quantity of gas flow were adjusted so that the mixed gas of an

gon and oxygen might be adjusted to Ar:O₂ = 1:1 and gas ** in a vacuum tub might serve as 5x10⁻³Torr, and the zinc-oxide layer was sputtered 300nm as 1st transparent dielectric film by the reactant sputter by sputter power 250W.

014] Next, the exhaust speed and the quantity of gas flow were adjusted so that the mixed gas of an argon and oxygen might be adjusted to Ar:O₂ = 1:1 and gas ** in a vacuum tub might serve as 5x10⁻³Torr as sputter gas, and the silicon-oxide layer was sputtered 35nm as 2nd transparent dielectric film by the reactant sputter by sputter power 500W.

015] Next, the exhaust speed and the quantity of gas flow were adjusted so that the mixed gas of an argon and nitrogen might be adjusted to Ar:N₂ = 1:4 and gas ** in a vacuum tub might serve as 5x10⁻³Torr as sputter gas, and a titanium-nitride layer was sputtered 15nm as a metal nitride layer of the 3rd layer by the reactant sputter by sputter power 500W.

016] Next, the exhaust speed and the quantity of gas flow were adjusted so that the mixed gas of an argon and oxygen might be adjusted to Ar:O₂ = 1:1 and gas ** in a vacuum tub might serve as 5x10⁻³Torr as sputter gas, and the silicon-oxide layer was sputtered 80nm as 3rd transparent dielectric film by the reactant sputter by sputter power 500W.

017] Thus, the optical property of ultraviolet-rays heat ray cutoff glass of having sputtered was fully intercepting the heat ray of solar light at 57% of solar radiation permeability with sufficient visibility required as the term of the aforementioned operation having described as a glass pane for automobiles at 70% of visible-ray permeability. Moreover, the cutoff performance of ultraviolet rays is also 10% or less in permeability with a wavelength of 380nm, and was fully intercepting detrimental ultraviolet rays.

018] The thickness of the silicon oxide of the 200nm and 3rd transparent dielectric film was set to 50nm for the thickness of the silicon-oxide layer of the 2nd transparent dielectric film on the same layer material as example 2 example 1, and sputtered conditions. The optical property in this configuration was fully intercepting the heat ray of solar light at 53% of solar radiation permeability with sufficient visibility demanded as glass at 70% of visible-ray permeability. Moreover, the cutoff performance of ultraviolet rays is also 10% or less in permeability with a wavelength of 380nm, and was fully intercepting detrimental ultraviolet rays.

019] The example of three examples describes that from which examples 1 and 2 and a layer material are different. After it carried out degreasing washing of the transparent glass substrate in isopropyl alcohol and the pure water subsequently washed, nitrogen blow drying was carried out. This transparent glass substrate was conveyed in the sputtering system, and it exhausted to 5x10⁻⁶Torr. In the vacuum layer, the zinc target for zinc-oxide layers used as 1st transparent dielectric film, the titanium target for titanium oxide used as 2nd transparent dielectric film, the titanium target for titanium-nitride layers used as a metal nitride layer of the 3rd layer, and the oxidation silicon target for silicon oxides used as 3rd transparent dielectric film were installed.

020] First, as sputter gas, the exhaust speed and the quantity of gas flow were adjusted so that the mixed gas of an argon and oxygen might be adjusted to Ar:O₂ = 1:1 and gas ** in a vacuum tub might serve as 5x10⁻³Torr, and the zinc-oxide layer was sputtered 300nm as 1st transparent dielectric film by the reactant sputter by sputter power 250W.

021] Next, the exhaust speed and the quantity of gas flow were adjusted so that the mixed gas of an argon and oxygen might be adjusted to Ar:O₂ = 1:1 and gas ** in a vacuum tub might serve as 5x10⁻³Torr as sputter gas, and the titanium oxide layer was sputtered 200nm as 2nd transparent dielectric film by the reactant sputter by sputter power 500W.

022] Next, the exhaust speed and the quantity of gas flow were adjusted so that the mixed gas of an argon and oxygen might be adjusted to Ar:N₂ = 1:4 and gas ** in a vacuum tub might serve as 5x10⁻³Torr as sputter gas, and titanium-nitride layer was sputtered 15nm as a metal nitride layer of the 3rd layer by the reactant sputter by sputter power 500W.

023] Next, the exhaust speed and the quantity of gas flow were adjusted so that the mixed gas of an argon and oxygen might be adjusted to Ar:O₂ = 1:1 and gas ** in a vacuum tub might serve as 5x10⁻³Torr as sputter gas, and the silicon-oxide layer was sputtered 50nm as 3rd transparent dielectric film by the reactant sputter by sputter power 500W.

024] The optical property in this configuration had sufficient visibility demanded as a glass pane for automobiles at 60% of visible-ray permeability, and was fully intercepting the heat ray of solar light at 55% of solar radiation permeability. Moreover, the cutoff performance of ultraviolet rays is also 10% or less in permeability with a wavelength of 380nm, and was fully intercepting detrimental ultraviolet rays.

025] The example of four examples describes the example which performed sputtering of the 1st and 2nd transparent dielectric films in the sol gel process. The zinc-oxide layer was sputtered in the sol gel process as follows as 1st transparent dielectric film. TSF400(Toshiba Silicone make) 5g was carried out as 100g (18%) of 2-ethyl hexanoic-acid, 80g (86% of linolic acid content) of dehydrated-castor-oil fatty acids, and a leveling agent, stirring mixture of the dehydrated xylene 320g was carried out as a diluent solvent, and the application liquid for zinc-oxide layers was obtained. It

As immersed, the transparent glass substrate which masked one side at this application liquid was pulled up the speed for 20cm/, and the application layer was obtained on one side. This application layer was dried and hardened at at-long-intervals infrared kiln at 150 degrees C for 15 minutes, it calcinated with the electric furnace for 15 minutes at 500 more degrees C, and the 750nm transparent zinc-oxide layer was ****ed.

[0026] Next, the silicon-oxide layer was ****ed in the sol gel process as follows as 2nd transparent dielectric film. Methyl trimetoxysilane 400g and tetramethoxy silane 150g were mixed, and, in addition to n-butanol 1600g, it mixed. After dropping 284g of the acetic-acid aqueous solutions 5 more%, it stirred for about 3 hours and the application liquid for silicon oxides was obtained by carrying out a standing at a room temperature for one day. It was immersed, the transparent glass substrate by which the zinc-oxide layer was ****ed by this application liquid like the above was pulled up the speed for 20cm/, and the application layer was obtained on one side. After having dried this application layer for 15 minutes at 120 degrees C and calcinating with an electric furnace for 30 minutes at 500 degrees C, it calcinated with the electric furnace for 2 minutes at 650 more degrees C, and ****ed 200nm of silicon-oxide layers on the transparent zinc-oxide layer.

[0027] Thus, the silicon-oxide layer was ****ed in 50nm spatter as 15nm and 3rd transparent dielectric film for the titanium-nitride layer as a metal nitride of the 3rd layer to the transparent glass substrate which ****ed the zinc-oxide layer and the silicon-oxide layer by the sol gel process. Spatter **** conditions were performed on examples 1 and 2 and these conditions. The optical property in this configuration was fully intercepting the heat ray of solar light at 58% of solar radiation permeability with sufficient visibility demanded as a glass pane for automobiles at 70% of visible-ray permeability. Moreover, the cutoff performance of ultraviolet rays is also 7% or less in permeability with a wavelength of 380nm, and was fully intercepting detrimental ultraviolet rays.

[0028] The example of five examples describes another example which performed **** of the 1st and 2nd transparent dielectric films in the sol gel process like the example 4. The zinc-oxide layer was ****ed 750nm by the technique same as 1st transparent dielectric film as an example 4. Next, titanium oxide was ****ed on the zinc-oxide layer as follows in the sol gel process as 2nd transparent dielectric film. It is at 80 degrees C about the solution which added tetraisopropoxy titanium 300mL into ethanol 2500mL first, and added glyceryl-monoacetate acetone 100g to this. It heated and stirred for 1.5 hours. It cools at 40 degrees C after this, water 18mL is added, and it is at 70 more degrees C. It heated and stirred for 1.5 hours and the application liquid for titanium oxide was obtained. It was immersed, the transparent glass substrate by which the zinc oxide was beforehand ****ed by this application liquid was pulled up the speed for 10cm/, and the application layer was obtained on one side by which the zinc oxide was ****ed. This application layer was calcinated with the electric furnace for 30 minutes at 500 degrees C, it calcinated for 2 minutes at 550 more degrees C, and 50nm of titanium oxide layers was obtained on the transparent zinc-oxide layer.

[0029] Thus, the silicon-oxide layer was ****ed in 50nm spatter as 15nm and 3rd transparent dielectric film for the titanium-nitride layer as a metal nitride of the 3rd layer to the transparent glass substrate which ****ed the zinc-oxide layer and the titanium oxide layer by the sol gel process. Spatter **** conditions were performed on examples 1 and 2 and these conditions. The optical property in this configuration was fully intercepting the heat ray of solar light at 57% of solar radiation permeability with sufficient visibility demanded as a glass pane for automobiles at 70% of visible-ray permeability. Moreover, the cutoff performance of ultraviolet rays is also 7% or less in permeability with a wavelength of 380nm, and was fully intercepting detrimental ultraviolet rays.

[0030]

[Effect of the invention] As explained above, the ultraviolet-rays heat ray cutoff window of this invention The 2nd transparent dielectric film which is different from the 1st transparent dielectric film as the 1st layer, and is different from the 1st transparent dielectric film as the 2nd layer from a substrate side on a transparent substrate, The performance which intercepts an infrared heat ray and ultraviolet rays simultaneously was obtained by having used the glass with which the laminating of the 3rd transparent dielectric film is carried out one by one, and it changes as a metal or a metal nitride layer, and the 4th layer as the 3rd layer.

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CLAIMS

[Claim]

[Claim 1] The ultraviolet-rays heat ray cutoff window characterized by carrying out the laminating of the 3rd transparent dielectric film one by one as a metal or a metal nitride layer, and the 4th layer as the 2nd transparent dielectric film which is different from the 1st transparent dielectric film as the 1st layer, and is different from the 1st transparent dielectric film as the 2nd layer from a substrate side on a transparent substrate, and the 3rd layer.

[Claim 2] The ultraviolet-rays heat ray cutoff window of the claim 1 publication characterized by using the multiple oxide which added the metallic element of a minute amount to the oxides or these multiple oxides, and these oxides of a cerium, titanium, zinc, chromium, or cadmium as 1st transparent dielectric film.

[Claim 3] The 2nd, Ultraviolet-rays heat ray cutoff window of the claim 1 publication characterized by using silicon, titanium, aluminum, tin, a zirconium, a tantalum, chromium, stainless steel, the oxides of Nichrome, or those multiple oxides as 3rd transparent dielectric film.

[Claim 4] The claims 1 and 2 characterized by using a metal or a nitride composites [of platinum, gold, silver, copper, titanium, chromium, aluminum, Nichrome, stainless steel, a zirconium, a hafnium, and a tantalum / any one or these composites] as the metal of the 3rd layer, or a metal nitride, or an ultraviolet-rays heat ray cutoff window given in three.

[Translation done.]